

**Meeting of the Argonne-Fermilab Collaboration on  
"Opportunities of Advanced Accelerator R&D at the NML Facility"**

**04/18/2011**

**Summary:**

1. Both labs see opportunities in exploitation of the NML facility for the projects of importance for their future. For ANL these are new types of high-brightness photon sources, while for Fermilab these are high beam intensity accelerators and colliders
2. Three experiment proposals have been identified as "high priority, high scientific impact":
  - a. Double Emittance Exchange (D-EEX) beam line for pulse shaping experiments (at 250-350 MeV)
  - b. Integrable Optics Test Accelerator (IOTA) to demonstrate new nonlinear optics solution (at 150-300 MeV)
  - c. High Brightness Compact Diamond Radiator (NIU/Vanderbilt) test experiment (at 40 MeV)
3. Several other tests and experiments have been discussed, many of them of significant interest, which require further exploration
4. Possible next steps: a) start to prepare proposal of "Experimental Program of Advanced Accelerator R&D at the NML Facility"; b) explore further the prospective users community and possibilities to attract them; c) investigate possibilities and formulate a proposal for the **UChicago Strategic Collaborative Initiatives Program**.

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**Agenda :** Monday, April 18, 2011 2:00 pm - 5:00 pm, at NML (Fermilab)

- 1) Introduction to the NML lab - Jerry Leibfritz - 20 minutes
- 2) Lab Tour - Jerry Leibfritz - 30 minutes
- 3) Open discussion of opportunities – M.Wendt, J.Power, P.Piot, R.Gerig, A.Valishev

Present: K.J.Kim, R.Gerig, J.Power (ANL), Y.E.Sun, A.Valishev, S.Henderson, J.Leibfritz,  
M.Church, S.Nagaitsev, M.Wendt (FNAL), P.Piot (NIU/FNAL)

Missed but submitted materials: A.Zholents, W.Gai (ANL)

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Minutes (taken by VS... see slides presented in beams-doc-xxxx at <http://beamdocs.fnal.gov/>):

1. VS opened the meeting, reminded the charge to the group (see SDH's memo at the end of this document)
2. Intro by JL: NML Phases I(infrastructure for CM1 2007-2010), II (1<sup>st</sup> beam operation 2011-12), III (complete RF unit test 10 MW RF with max 80 kW e- beam power), design config is still to have 3 CM, space allows 3, Philippe's optics may need 3+1 for HE compression
3. Tour (JL): quite impressive SC RF work, CM1 is being commissioned (first problems identified and being fixed), 5MW klystron works, vast space of the AARD building which will easily fit 3 test beam lines and one ring
4. (discussion started) Manfred W.: outlined beam diagnostics needs for the facility both at high/low energy and high/low charge areas; listed 10 beam instrumentation R&D items to do at the NML test lines; NML is unique facility it turned to SASE FEL with  $E_{\gamma}=10-1000$  eV – FLASH shows that many users will line up for it; discussion – is such facility needed in the US? NML can host "a-la-STELLA" (STELLA upgrade?) – staged IFEL facility (50 MeV e-  $\rightarrow$  1 GeV e-)
5. RG presented Sasha Z slides: D-EEX beam line can be set at NML, requires some 40-50 m of space and ~350 MeV e-; NML offers better availability and x100 avg power than ANL linac area; the beam line can demo bunch shaping (triangular bunch as needed for TR>2 wakefield accel), bunch-train generation (slits in the telescope area) and later on exploited for demonstration of a DWA-based FEL unit (upto 4 GeV test beam gain if 400 MeV e- bunch current properly shaped)
6. John P : Plasma WFA at NML - NML can generate high charge and, with pulse compression, generate a short beam which may be capable of achieving in high gradients, so it will be better than FACET because of multi-bunch operation and possibility to test PWFA on e+; discussion – whether e+ operation is in FACET (seems that "not in the present reduced form"), FACET time scale (2015? Seems to be scheduled to free up the space for the approved LCLS-II upgrade), can all FACET experiments/users move to NML? (not if FACET will move upstream and tap-off the

LCLS beam), SN showed the list of highly ranked FACET experiments – a) ultrafast processes (what is that? Can we find solid state folks in UC and Northwestern to be interested in similar stuff?) ; b) PWFA; c) Smith Purcell ; d) DWA – Rosenzweig

7. Sergei commented that our (midWest AARD cluster) strengths, expertise and interest is NOT (only?) high accelerating gradients but (mostly) phase space manipulation techniques and control
8. JP presented proposal to use NML for e+ target studies (advantage – a lot of beam power) – Q: is that for ILC only? A: mb CLIC, mb B-fact, there will be users;
9. VS commented that users love ATF which sets up ~7 experiments/yr (total ~20 in pipeline – in the proposal stage and being carried out)
10. Philippe P : described how NML can be used for photoinjector performance studies (collab with Los Alamos), tailoring the bunch current shapes (a lot of interest), THz radiation and DWFA; most attracting is “the DOD challenge” proposal – High Brightness Compact gamma-radiation by channeling e- in diamond (NIU/Vanderbilt)
11. Alex V: IOTA ring being designed, allows large dQ (~1/2 of the tune Q) and suppression of resonances and TMCI; it needs 150-300 MeV e- (see the slides); later, the ring can be modified to test OSC (optical stochastic cooling)
12. Closeout and Adjourn :a) summary to be written; b) FNAL folks will take part in the Argonne ‘s DWA workshop 04/20-21/2011; c) next steps – TBD later

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S.Henderson 12/03/2010

**Charge to the Working Group on**

**Scientific Opportunities for Advanced Accelerator R&D at Fermilab’s  
New Muon Laboratory Facility**

Charge:

Carry out a study, culminating in a written report, to identify the Scientific Opportunities made available by an Advanced Accelerator R&D (AARD) User Program operated at Fermilab’s New Muon Lab (NML) facility. In preparing this report, consider the following:

- Scientific opportunities are to be broadly considered, independent of the potential ultimate application or potential funding source
- The capabilities and distinguishing characteristics of NML as a user facility should be described within the national and international context of other AARD facilities
- The report should clearly articulate those opportunities that are unique to NML, that is, that cannot readily be pursued elsewhere
- The report should clearly articulate the potential benefit to science and society that would accrue from pursuing these scientific opportunities
- The report should highlight, amongst the many opportunities, the top three flagship experiments that exploit the unique characteristics of the NML beam facility.

The report should be delivered by April 18, 2011.